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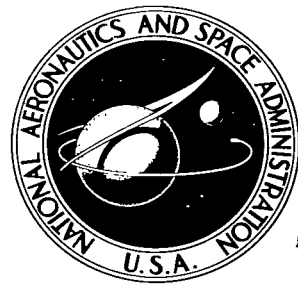

FLUORINE UPTAKE OF FLUOROCARBON GREASES

by Patricia M. O'Donnell

Lewis Research Center

Cleveland, Ohio

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SUMMARY

The fluorine uptake of four fluorocarbon greases was studied in a glass apparatus at 100° C and a fluorine pressure of 110 millimeters of mercury. The reactivity varied with the composition of the greases. The lowest fluorine uptake was observed with a grease formulated with polychlorotrifluoroethylene as the base material and a perfluorocarbon filler. When the same base material was retained but the filler was changed to a silica filler, a high fluorine uptake was observed.

INTRODUCTION

Fluorocarbon greases can be used satisfactorily in systems handling gaseous fluorine; however, the formulation of these greases is an important factor in determining their reactivity. It was the object of this experiment to determine the reactivity of four fluorocarbon greases with gaseous fluorine at 100° C and 110 millimeters of mercury.

PROCEDURE

The glass apparatus used to study the fluorine uptake of the greases is shown schematically in figure 1. The grease samples were weighed in porcelain boats and placed in a quartz reaction tube, which was then heated to the appropriate temperature, and fluorine was introduced to the desired pressure. The weight of fluorine consumed was calculated from the drop in pressure in the system of known volume. As fluorine was consumed, more fluorine was added to the reaction section to maintain the pressure to within 2 millimeters of mercury of the initial value.

RESULTS

The four fluorocarbon greases exposed to fluorine were KEL-F, KEL-F-90, KFL 1477, and 3ML 1429. The first three greases all have polychlorotrifluoroethylene as their base material. KEL-F and KEL-F-90 are silica filled, whereas KFL 1477 has a perfluorocarbon filler. Grease 3ML 1429 has a perfluorocarbon base material and a perfluorocarbon filler. The fluorine uptake of these four

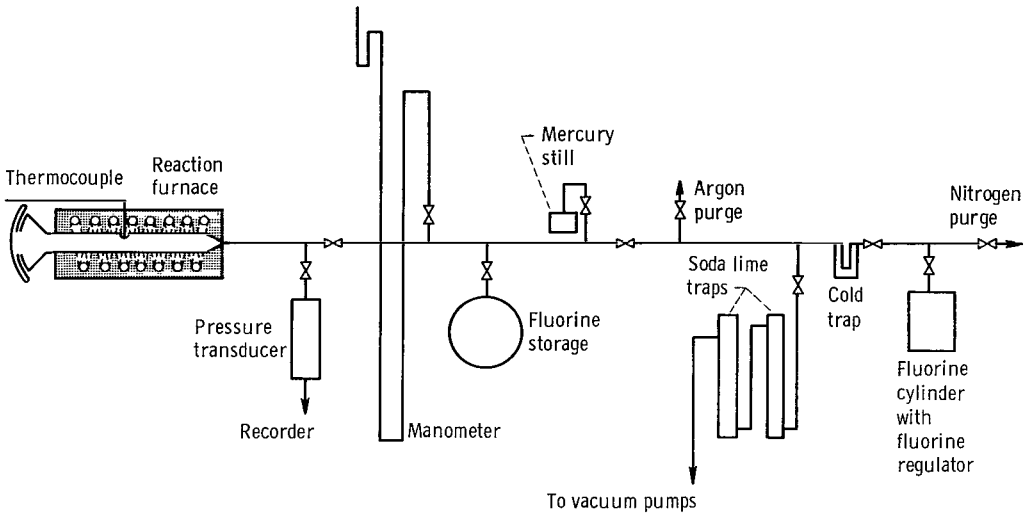

Figure 1. - Apparatus for determination of fluorine uptake of fluorocarbon greases.

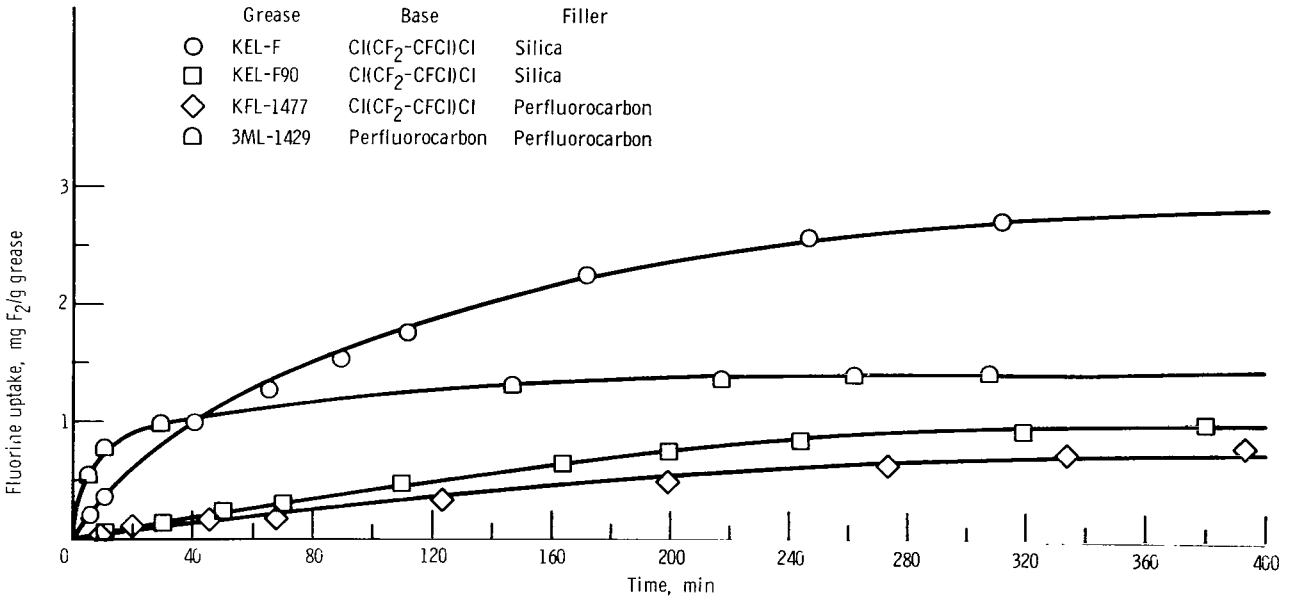

Figure 2. - Fluorine uptake by fluorocarbon greases at 100° C and fluorine pressure of 110 millimeters of mercury.

greases and their formulations are given in figure 2.

DISCUSSION

In a previous experiment (ref. 1) where copper was reacted with fluorine, the presence of cupric chloride ($CuCl_2$) was identified, and it was found that the fluorine had replaced some of the chlorine from the polychlorotrifluoroethylene base material of the grease that had been used as a lubricant in the system. The possibility of fluorine reacting with the silica filler could explain why KEL-F and KEL-F90 are more reactive than KFL 1477. The reactivity of

3ML 1429 is relatively high despite its completely fluorinated composition. It was determined by weight loss measurements that, after 400 minutes at 100° C and a fluorine pressure of 110 millimeters of mercury, KEL-F, KEL-F90, and KFL 1477 had lost 3 percent of their weight, whereas 3ML 1429 had lost 80 percent of its weight. These weight losses were determined by weighing the grease samples in the boat before and after a run. The vaporized products condensed at the cool ends of the reaction vessel. Similar weight losses of 3 and 82 percent were observed in blank runs using argon gas; however, there was no detectable pressure change in these blank runs. It is possible that fluorine uptake is partly or entirely a vapor phase reaction and hence proceeds more extensively with 3ML 1429. This is consistent with the earlier leveling off of the 3ML 1429 curve. It would be interesting to investigate the mechanisms of these reactions further.

Lewis Research Center
National Aeronautics and Space Administration
Cleveland, Ohio, August 5, 1964

REFERENCE

1. O'Donnell, Patricia M., and Spakowski, Adolph E.: Reaction of Copper and Fluorine from 800° to 1200° F. NASA TN D-768, 1961.

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